# Appendix E
# ADDITIONAL PROJECT DETAILS

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*This appendix includes additional project details specific to project sites discussed in Chapter 4 of the Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS).*

## WATER CONTAMINATION ISSUES IN THE RIO GRANDE, FROM THE COLORADO BORDER TO THE MIDDLE-RIO GRANDE

### SUMMARY

Public meetings held by the U.S. Department of Energy (DOE), National Nuclear Security Administration in 2006 identified public concerns regarding contamination of the Rio Grande. The Rio Grande has been a source for drinking water supply since the earliest settlements. Land practices in the upper and middle Rio Grande basins have contributed to contamination of soils, surface water and groundwater resources. Contaminant pathways into the Rio Grande and onto public lands are poorly understood and continue to be a focus of ongoing research. While contamination from DOE activities in the upper and middle Rio Grande basins has occurred, it has not caused exceedances of regulatory standards off DOE property.

Since the 1920s, the Federal government has intervened in the management of flows to assist in delivery of water to communities for drinking water supply, irrigation, industrial and agricultural uses. Communities in New Mexico traditionally utilize groundwater resources as community potable water sources. However, drought conditions and over-mining groundwater resources has prompted many to seek surface water resources to replace or augment their community drinking water source. The Rio Grande is the fifth largest river in North America. Its flows are sustained by surface water runoff and San Juan-Chama Project water. The San Juan-Chama Project, initiated in 1962 and managed by the U.S. Bureau of Reclamation, transfers water from the San Juan River basin in southern central Colorado to the Rio Grande basin in northern central New Mexico through a system of diversion structures and tunnels. Recent changes to San Juan-Chama Project agreements has enabled communities the opportunity to directly access San Juan-Chama water from the Rio Grande. Although several communities have expressed an interest in developing direct access to the San Juan-Chama water, three diversion projects are in various stages of development.

## E.1 INTRODUCTION

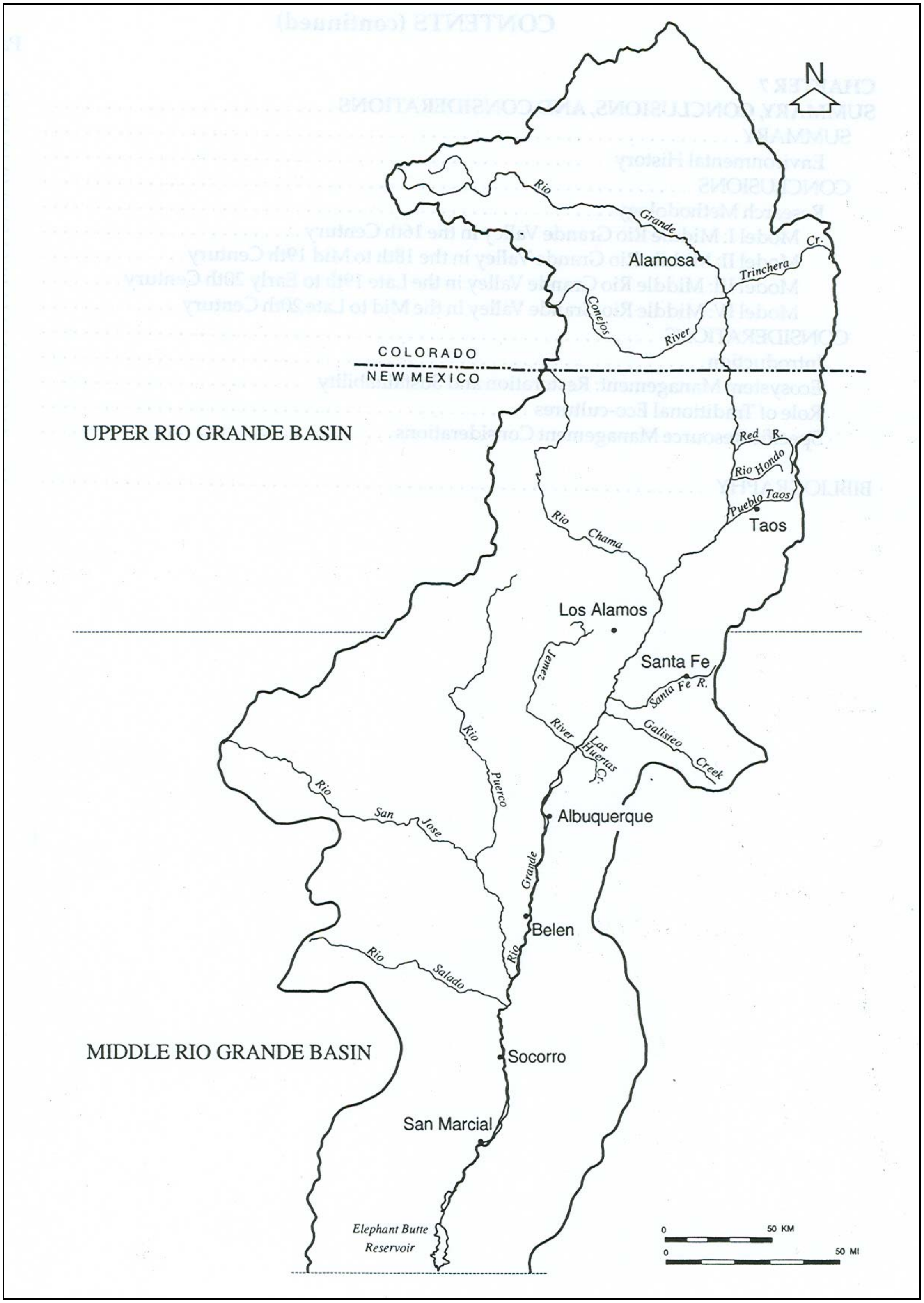
In 2006, the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA) undertook an effort to analyze the environmental impacts of the continued transformation of the United States' nuclear weapons complex by implementing the NNSA's vision of the complex as it would exist in the future, otherwise known as Complex 2030 (71 FR 61731). Scoping meetings held for the Complex Transformation project in 2006 identified several areas of concern in New Mexico, one of them being concern over water issues. In this paper, water issues in northern New Mexico are examined based upon existing research conducted by various agencies and groups. No new studies were completed for this analysis.

This paper focuses upon the Rio Grande and its major tributaries in northern New Mexico, from the Colorado border to Albuquerque, in central New Mexico (Figure E.1-1). The Rio Grande is the fifth largest river in North America. It flows 1,885 miles from southern Colorado to extreme southern Texas, where the river empties into the Gulf of Mexico (USDA 1998). The discharge area of the Rio Grande in New Mexico is estimated at 27,760 square miles, with direct tributary drainage area of 24,760 square miles (USDA 1998). Rio Grande headwater elevations range from 8,000 to 12,000 feet and flatten to between 5,225 to 4,450 feet in the middle Rio Grande Valley, near Albuquerque (USDA 1998). For the purposes of this discussion, the tributaries in the upper and middle Rio Grande basins are Red River, Rio Hondo, Rio Pueblo de Taos, Rio Chama, Santa Fe River, Jemez River, and the Santa Fe River. Predominant communities along these tributaries are the Town of Taos, Cities of Española, Los Alamos, Santa Fe and Albuquerque, Pueblo of Taos, Ohkay Owingeh Pueblo (formerly San Juan Pueblo), Pojoaque Pueblo, Tesuque Pueblo, San Ildefonso Pueblo, Picuris Pueblo, Cochiti Pueblo, Santa Ana Pueblo, and Sandia Pueblo.

## E.2 HISTORY OF ACTIVITIES

The Rio Grande has been a source of water for generations. At the time of first European contact, there were more than 50,000 Pueblos living in over 100 villages in the middle and upper basins of the Rio Grande (USDA 1998). Irrigation ditch agriculture was limited at this time, but intensified as larger populations settled the areas. Acequia systems took root as conveyors for drinking water, bathing, washing clothes, irrigation, and watering livestock (USDA 1998). As irrigation intensified, river flow in the Rio Grande was severely reduced or even halted. Reduced flows in the Rio Grande have been recorded since 1925.

In 1923, Federal legislation established conservancy districts to address surface water issues. These conservancies were tasked with regulating stream flow, developing or reclaiming sources of water, and generating electrical energy. In 1928, a plan to develop various water control measures was announced, which called for the construction of dams and diversions along the Rio Grande. From 1930 to 1934, six diversion dams, the El Vado dam and storage reservoir on the Chama River, 250 miles of main irrigation canals, 350 miles of drainage canals, and 190 miles of levees was completed (USDA 1998). Between 1935 and 1975, the Middle Rio Grande Conservancy District, the U.S. Army Corps of Engineers (ACOE) and the U.S. Bureau of Reclamation (BOR) constructed and presently manages six major dams on the upper and middle Rio Grande drainages to control floods, store water, and catch sediment (Table E.2-1).




Source: USDA 1998.

**Figure E.1-1—Geographic Layout of Streams, Mountain Ranges and Communities Along the Rio Grande**

**Table E.2-1—Upper and Middle Rio Grande Dams and Reservoirs**

| Name | Stream | Year Completed |
|---|---|---|
| Flood Control- Water Storage | | |
| El Vado | Chama | 1936 |
| Jemez Canyon | Jemez | 1953 |
| Abiquiu | Chama | 1963 |
| Heron | Willow | 1963 |
| Galisteo | Galisteo | 1970 |
| Cochiti | Rio Grande | 1975 |
| Irrigation Diversion- Rio Grande | | |
| Cochiti | | 1936 |
| Angostura | | 1936 |
| Isleta | | 1936 |
| San Acacia | | 1936 |

Source: USDA 1998.

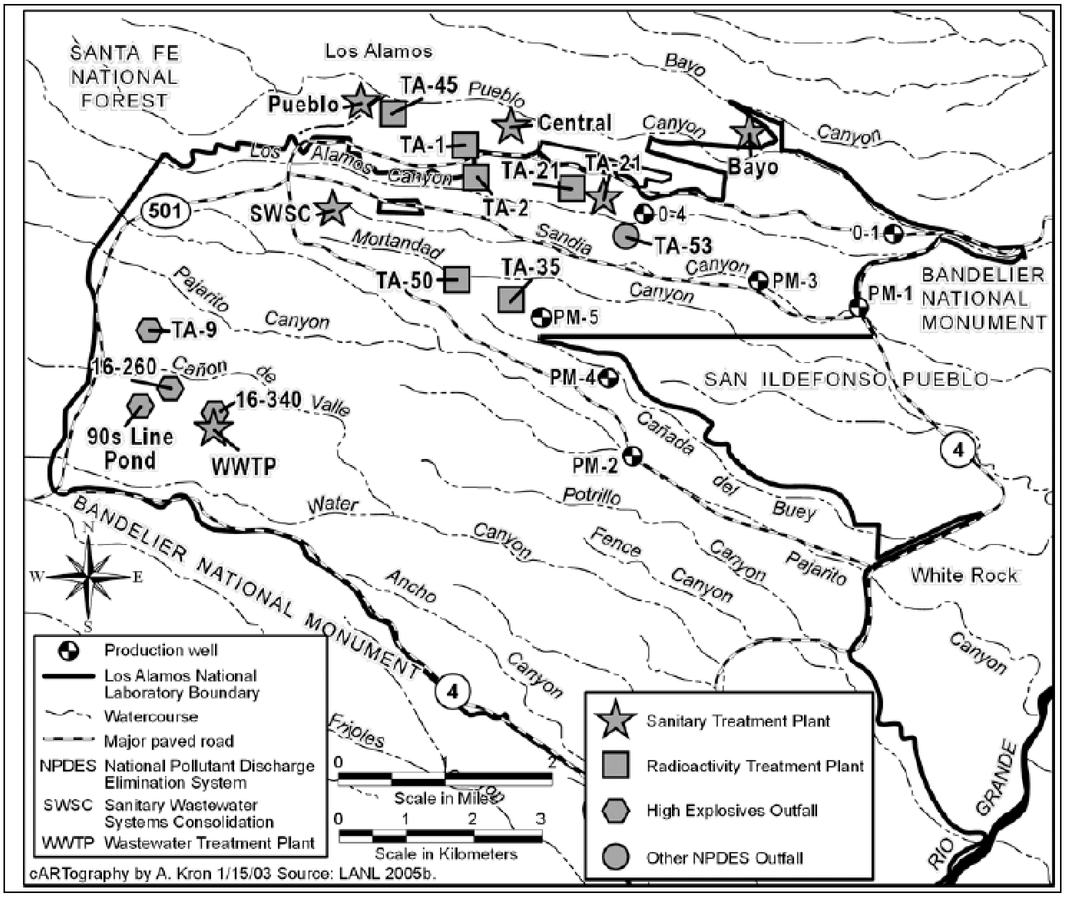
The San Juan-Chama project was initiated in 1962 (BOR 2006). The San Juan-Chama Project diverts water from the upper tributaries of the San Juan River, through the Continental Divide, and into the Rio Grande Basin. It consists of a two storage dams, two reservoirs, three diversion dams, six carriage facilities, five tunnels and the Azotea Creek and Willow Creek Conveyance Channels for transmountain movement of water, originating in Archuleta County in southern central Colorado and Rio Arriba County in northern central New Mexico (BOR 2006). The San Juan-Chama Project provides an average annual diversion of about 110,000 acre-feet of water (BOR 2006). The primary purposes of the San Juan-Chama Project are to furnish a water supply to the upper and middle Rio Grande valley for municipal, domestic, and industrial uses. The San Juan-Chama Project is also authorized to provide supplemental irrigation water and incidental recreation and fish and wildlife benefits. The BOR is the agency responsible for the San Juan-Chama Project.

## E.3 LOS ALAMOS NATIONAL LABORATORY

Los Alamos National Laboratory (LANL) was established in 1943 with the mission to research and develop the world's first atomic bomb. The mission of LANL has continued to evolve as our Nation's needs change. Improvements in laboratory practices and establishment of environmental regulations fostered stewardship of the environment. LANL sits atop Pajarito Plateau in north central New Mexico, approximately 40 miles northwest of Santa Fe. The Pajarito Plateau consists of a series of east-west oriented mesas separated by deep canyons with perennial and intermittent streams. LANL is bounded on the west by the Jemez Mountains and on the east by the Rio Grande.

From 1943 to the present, operations at LANL have generated, treated, stored and disposed of solid wastes, hazardous wastes, and hazardous wastes mixed with radioactive wastes. Solid, hazardous, and radioactive waters were disposed of in numerous septic systems, surface impoundments, pits, trenches, shafts, landfills, waste piles, and other sites located throughout LANL. The types of hazardous and solid wastes that have been handled and disposed of include chlorinated and non-chlorinated solvents, high explosives, metals, polychlorinated biphenyls (PCBs), nitrates, and radionuclides (NMED 2005a). Over the last 50+ years, the wastes from LANL began to migrate down the complicated mesa-and-canyon geography, toward the Rio

Grande (Buske 2003). Past LANL activities have resulted in contamination of sediments both onsite and downstream, primarily transported by effluent discharges from LANL outfalls and stormwater runoff (LANL 2008). Figure E.3-1 shows the major liquid release sources at LANL. Current LANL operations are stringently controlled to minimize the amount of contamination introduced into the local canyons. LANL has 21 outfalls currently permitted which discharge into six local canyons. Five canyon that previously received LANL discharges are no longer receiving nay industrial effluent L Pueblo, Cañada del Buey, Guaje, Chaquehui, and Ancho Canyons. Total effluent discharges from LANL decreased by about 50 percent over the past five years (LANL 2008).



Source: LANL 2008.

**Figure E.3-1—Major Liquid Release Sources at LANL**

The Cerro Grande Wildfire in 2000 revealed how dramatically changing conditions can suddenly flush contaminants from LANL towards the Rio Grande. Springs on the flanks of the Sierra de los Valles supply base flow into upper reaches of some of the canyons (Guaje, Los Alamos, Pajarito, Cañon del Valle, and Water Canyons), but the amount is insufficient to maintain surface flow across the plateau before it is depleted by evaporation, transpiration, and infiltration. Runoff from heavy thunderstorms or heavy snowmelt reaches the Rio Grande several times a year in some drainages (Purtymun 1995). Spring discharge in lower Pajarito and Ancho Canyons is of sufficient volume to support perennial flow into White Rock Canyon and the Rio Grande (Purtymun 1995). Table E.3-1 shows the surface water and sediment contamination attributable to LANL operations (LANL 2008). Other possible sources of surface water impacts are isolated spills, former photographic processing facilities, highway runoff, and residual Cerro Grande Fire ash (LANL 2008).

**Table E.3-1—Surface Water and Sediment Contamination Attributed to LANL Operations**

| Contaminant | Onsite | Offsite | Significance | Trends |
|---|---|---|---|---|
| Radionuclides in sediments | Higher than background in sediments because of LANL contributions in Pueblo, DP, Los Alamos, Pajarito and Mortandad Canyons | Yes, in Los Alamos, Acid, and Pueblo Canyons; and slightly elevated in the Rio Grande and Cochiti Reservoir. | Sediments below health concern, except onsite along a short distance of Mortandad Canyon; exposure potential is limited. | Increased transport of contaminated sediments in Pueblo Canyon in response to post-fire flooding and increased urbanization. |
| Radionuclides in surface water | Higher than background in runoff in Pueblo, DP, Los Alamos, and Mortandad Canyons. | Yes, in Los Alamos and Pueblo Canyons. | Minimal exposure potential because storm events are sporadic. Mortandad Canyon surface water is 60 percent of Derived Concentration Guide. | Flows in Pueblo Canyon occurring more often after the Cerro Grande Fire. Flows in other LANL canyons recovered to near pre-fire levels. |
| Polychlorinated biphenyls in sediments | Detected in sediment in nearly every canyon. | Yes, particularly in Los Alamos and Pueblo Canyons. | Wildlife exposure potential in Sandia Canyon. Elsewhere, findings included LANL and non-LANL sources. | None |
| Polychlorinated biphenyls in surface water | Detected in Sandia Canyon runoff and base flow above New Mexico Water Quality Standards. | No. | Wildlife exposure potential in Sandia Canyon. Elsewhere, findings included LANL and non-LANL sources. | None |
| Dissolve copper in surface water | Detected in many canyons above New Mexico acute aquatics life standards. | Yes, in Los Alamos Canyon. | Origins uncertain; probably multiple sources. | None |
| High explosive residues and Barium in surface water | Detections near or above screening values in Cañon de Valle base flow and runoff. | No. | Minimal potential for exposure, | None |
| Benzo(a)pyrene | Detections near or above industrial screening levels in Los Alamos Canyon. | Yes, in Los Alamos and Acid Canyons. | Origins uncertain; probably multiple sources. | None |

Source: LANL 2008.

Three zones of groundwater occur on the Pajarito Plateau: (1) perched alluvial groundwater in canyon bottoms, (2) zones of intermediate depth perched groundwater whose location is controlled by availability of recharge and by subsurface changes in permeability; and (3) the regional aquifer beneath Pajarito Plateau (LANL 2008). Alluvial water is groundwater that occurs in canyon-floor sediments. Perched intermediate groundwater is water that has moved downward from the surface and becomes trapped above tight geologic formations, such as basalts and clay-rich rocks. The regional groundwater is the deep reliable source of drinking water for residents of Los Alamos, Española, Santa Fe and neighboring Pueblos. The regional aquifer discharges to springs along the Rio Grande. The knowledge base of recharge, discharge, and how waterborne contaminants interact with and move through geology into perched water zone and the regional aquifer below LANL is growing. Models are being improved based upon updated data for groundwater and surface water from LANL and NMED (LANL 2008).

Perched water bodies are important elements of the hydrogeology of LANL for several reasons. There is a probability that the zones can intercept contaminants that are being transported downward through the vadose zone. The perched water can be a permanent or long-term residence for contaminants because the chemical makeup of the geology may result in adsorption. Perched water can also serve as a place where dilution occurs lowering the concentration of contaminants. There is a possibility that perched zones may be intersected by streams in the lower parts of the canyons, resulting in lateral flow under the influence of gravity out of the canyon walls into the aquifer, and subsequently the Rio Grande (LANL 2008). Little contamination reaches the deep regional aquifer because it is separated from the perched groundwater by hundreds of feet of dry rock (LANL 2008). Results of groundwater monitoring show the presence of LANL-produced contamination, above water quality standards, in the alluvial groundwater and in some perched intermediate groundwater in Mortandad, Los Alamos, Cañon del Valle DP and possibly Pueblo Canyons (LANL 2006). Groundwater in Mortandad Canyon area is contaminated with tritium, perchlorate, chloride, and nitrate at levels below drinking water standards (NMED 2005b).

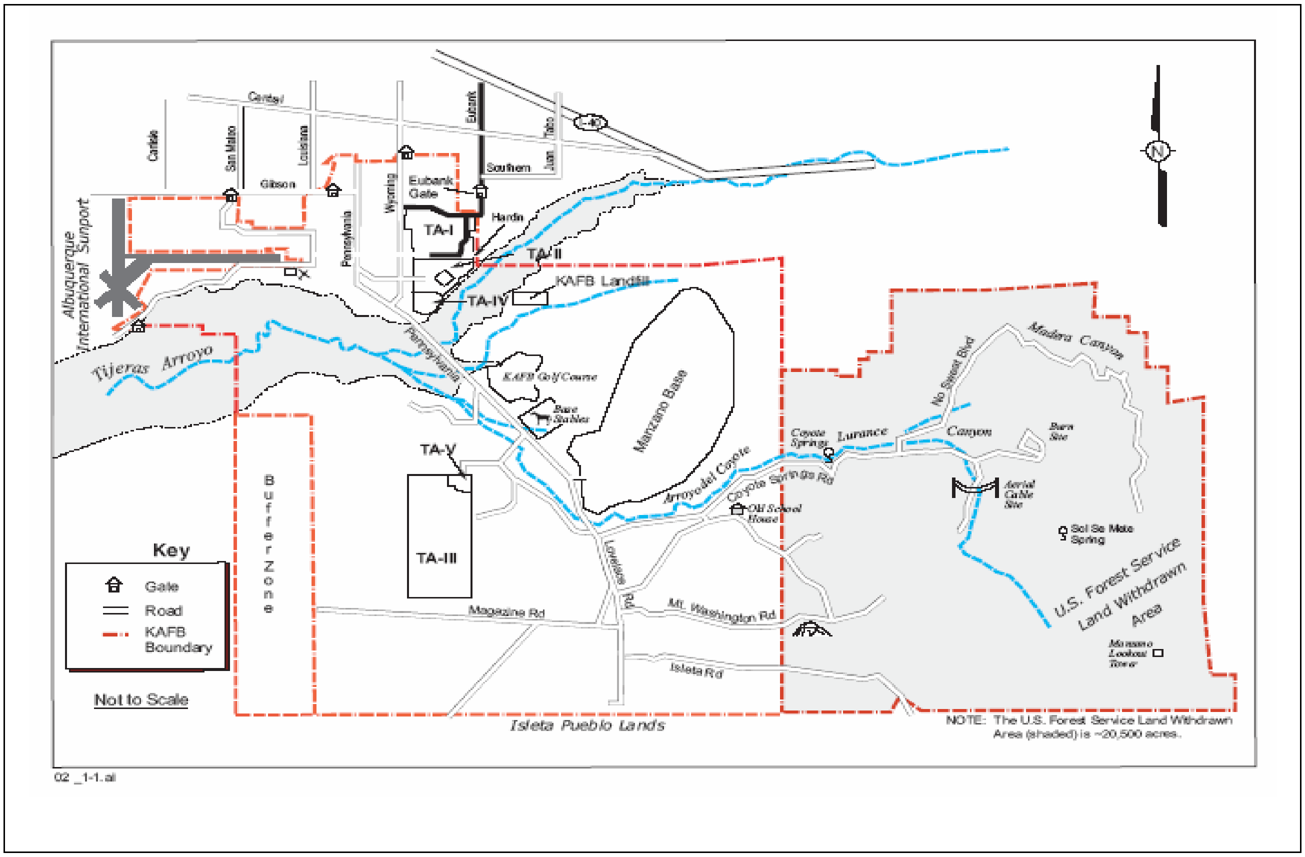
A separate study, conducted by George Rice for Concerned Citizens for Nuclear Safety (CCNS), found that contamination from LANL is likely to reach the Rio Grande (Rice 2004). Citing data from NMED and LANL, Rice models groundwater transport from LANL to the Rio Grande. He concluded that although the travel time of contaminants varies, it is possible for contaminants from LANL to reach the Rio Grande in 61 years or less (Rice 2004).

Further groundwater studies conducted jointly by The RadioActivitst Campaign (TRAC) and the CCNS indicated that radioactive waste has migrated from LANL via groundwater pathways to springs seeping into the Rio Grande, albeit at levels far too low to be considered a public health concern (Buske 2003). Low levels of radioactive cesium-137 (Cs-137) from LANL have been detected in groundwater seeping into Pajarito Stream, which flows into the Rio Grande (Buske 2003). This is the first report of radioactivity entering the Rio Grande directly connected with LANL activities. Additional analysis is necessary to adequately characterize and identify the pathway and extent of contamination.

## E.4 SANDIA NATIONAL LABORATORY

Sandia National Laboratory (SNL) is located on Kirtland Air Force Base (KAFB) in Albuquerque, New Mexico, along the eastern portion of the Sandia Mountains in the southeast quadrant of the city. SNL began in 1945 as a part of the Manhattan Project, which produced the world's first nuclear weapon (SNL/NM 2006). SNL's enduring mission is to provide science and engineering support for the nuclear weapons stockpile (SNL/NM 2006).

SNL is situated at the base of the Sandia Mountains. The Sandia Mountains form a 13-mile long escarpment distinguished by steep cliffs, pinnacles, and narrow canyons. Tijeras Canyon divides the Sandia Mountains to the north from the Manzanita Mountains to the south. Sediments transported from the canyons and draws of these mountains have formed coalescing alluvial fans, called bajadas. These bajadas slope west across KAFB and are dissected by the Tijeras Arroyo, smaller arroyos and washes. Tijeras Arroyo traverses across SNL in a southwestern direction, and discharges to the Rio Grande approximately 8 miles west of the KAFB boundary (Figure E.4-1). The major surface drainages at SNL are Tijeras Arroyo and Arroyo del Coyote. With the exception of two short sections of channel with intermittent flow (spring fed), these drainages flow only during storm events. Tijeras Arroyo is the only substantial outlet for surface water exiting KAFB. Arroyo del Coyote joins Tijeras Arroyo approximately 2 miles up stream where Tijeras Arroyo leaves KAFB, northwest of the KAFB Golf Course.




Source: SNL/NM 2006.

**Figure E.4-1—Map of SNL**

## E.4.1 Surface Water Monitoring

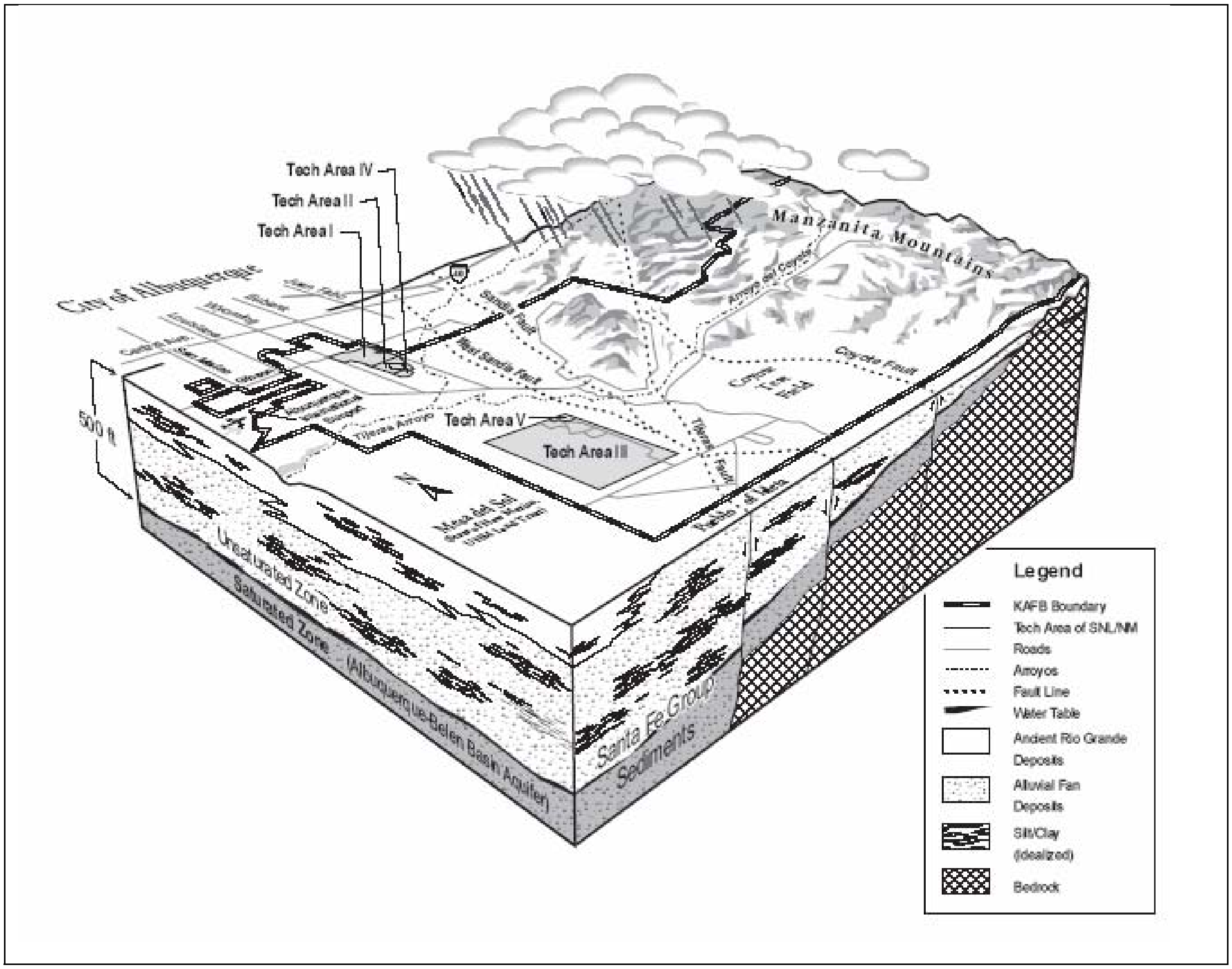
The surface water system on KAFB is a reflection of the dry high-desert climate of the area. Surface water flows through several major and many minor unnamed arroyos, primarily during summer monsoon events. With the exception of flow from two springs, there are no perennial streams or other surface water bodies at KAFB. Several unnamed arroyos and drainages to the south of Arroyo del Coyote dissipate as the topographic relief decreases to the west. Storm water in this area either evaporates or infiltrates into the soil. Therefore, there is no hydrologic surface connection from these areas to Tijeras Arroyo or the Rio Grande.

Surface discharges are releases of water and water based compounds made to roads, open areas or impoundments. Surface discharges are only made with the approval of the Internal Surface Discharge Program. Proposed discharges are evaluated for potential contaminants and concentration levels to determine if the discharge complies with strict water quality guidelines for surface releases. Uncontaminated water discharges must also be approved since large volumes of water discharged in areas of prior contamination could increase infiltration rates and move contaminants deeper into the soil column.

### E.4.2 Groundwater Monitoring

Water resources at SNL are characterized through an extensive network of wells and monitoring stations. The network supports an active environmental monitoring program covering groundwater, surface water and air. The Groundwater Protection Program (GWPP) and the Environmental Restoration (ER) Project collect groundwater data at SNL. Both programs coordinate to monitor wells throughout SNL. The GWPP establishes baseline water quality and groundwater flow information, determines if any impact from SNL operations is affecting groundwater quality, and maintains compliance with local, state, and federal regulations. The ER Project conducts groundwater monitoring in six project areas: Chemical Waste Landfill (CWL), the Mixed Waste Landfill (MWL), Technical Area V (TA-V), Tijeras Arroyo Groundwater (TAG, formerly Sandia North) Investigation, Canyons Area, and Drain and Septic Systems (DSS).

The groundwater beneath the western portion of KAFB is part of an interconnected series of water-bearing geologic units within the Albuquerque Basin that form the Albuquerque-Belen aquifer (Figure E.4-2.). Groundwater beneath the eastern portion of KAFB occurs in limited quantities in fractured bedrock. Over 170 wells are used to monitor and supply water to KAFB and the surrounding areas of the City of Albuquerque. The ER project has detected chromium concentrations exceeding EPA maximum containment level values. However, these exceedances correlate with nickel results and may be attributed to corrosion of Type 304 stainless steel well screens (SNL/NM 2007). The stainless steel corrosion product is in a particulate form, and as such, is unlikely to migrate into groundwater. Although water levels may fluctuate over the course of the year in response to seasonal recharge and groundwater withdrawal, the overall level of the regional aquifer within the basin continues to decline at about one foot per year (SNL/NM 2006).




Source: DOE 1999.

**Figure E.4-2—Conceptual Diagram of Groundwater Systems Underlying KAFB**

In 2006, the GWPP reported the detection of trace amounts of VOCs, elevated nonmetal inorganic compounds, and levels of beryllium and uranium above the MCL[1], and elevated gross alpha (SNL/NM 2007). None of the VOCs exceeded MCL standards. VOCs are attributed to laboratory cross-contamination or residual disinfection products. Elevated concentrations of non-metal inorganic compounds (e.g., chloride, sulfate, fluoride, etc.) are attributable to natural sources in the local area (SNL/NM 2007). At all locations except one perchlorate was detected at concentrations above the detection limit. However, perchlorate was detected at 1.26 milligrams per liter and 1.08 milligrams per liter (SNL/NM 2007). No MCL or MAC are established for perchlorate. In 2006, metals were detected below the MCLs and MACs at all locations except Coyote Springs and EOD Hill. Beryllium detected at Coyote Springs appears to be of natural origin and consistent with previous analysis (SNL/NM 2007). Uranium was detected above the MCL at EOD Hill. Mercury was not detected in any of the groundwater

[1] The U.S. EPA regulates drinking water constituents by setting a maximum contaminant levels (MCLs). The New Mexico Water Quality Control Commission (NMWQCC) regulates drinking water constituents by establishing maximum allowable concentrations (MACs).

samples. Additionally, analysis for radionuclide activity, when uncorrected, shows values above the MCL. However, removing the natural sources from the analysis, results in radioactivity levels below the MCLs. Exceedances for uranium and corrected gross alpha were detected above the recently established MCL at EOD Hill (SNL/NM 2007). Corrected gross alpha accounts for natural uranium levels in the surrounding environment. Wells with elevated uranium are located east of the Tijeras fault complex, where groundwater contacts bedrock material that contains minerals naturally high in uranium (SNL/NM 2007). Radium-226 was detected above the MCL for combined radium-226 and -228 (SNL/NM 2007).

The groundwater beneath the SNL and adjacent areas is the source of drinking water for SNL, KAFB, adjacent portions of the City of Albuquerque, and the Pueblo of Isleta. Groundwater quality can be influenced by the presence of contaminants in the soil column above the groundwater, as well as the groundwater itself. These influences are of major concern to the ER Project, which is investigating the nature and extent of groundwater contamination from past activities. All known groundwater contamination is the result of past activities that occurred before the enactment of environmental regulatory laws. The ER Project monitors sites of known or potential groundwater contamination. Measurements of indicate that some contaminants exceed regulatory limits (Table E.4-1). Investigations or remediation of these sites is on-going. The following discussion on groundwater contaminants is based on 2005 monitoring and assessment data (SNL/NM 2006).

Past surface water sampling results from 1998 and 1999 analysis have shown a presence of metals such as zinc, magnesium, and iron elevated above the benchmark values. No unusual characteristics were observed in 2001, 2002, and 2003. No monitoring was required in 2000. Monitoring results in 2004 identified elevated levels of total suspended solids (TSS) and magnesium. Albuquerque’s semiarid climate with sparse vegetative cover and high erosion rates naturally produce high TSS levels. SNL has reduced TSS levels in developed areas through best management practices, such as retention and detention ponds, landscaping conducive to infiltration and lining of storm drain channels for erosion reduction. All monitoring points show elevated levels of magnesium even though they are separated by several miles and collect runoff from several different drainages. The presence of zinc, magnesium and iron may be due to natural conditions associated with rocks and soils derived from the igneous/metamorphic complex of the Manzanita Mountains.

**Table E.4-1—ER Project Groundwater Monitoring Results from Calendar Year 2006**

| Sample | Concentration | Period |
|---|---|---|
| Beryllium<br>MCL = 0.004 mg/L | 0.00805 mg/L | February/March 2006 |
| Radium 226<br>MCL (226 + 228) = 5 pCi/L | 8.24 pCi/L | February/March 2006 |
| Fluoride<br>MCL + 4.0 mg/L<br>MAC = 1.6 mg/L | 1.64 mg/L | February/March 2006 |
| | 1.61 mg/L | February/March 2006 |
| | 2.67 mg/L | February/March 2006 |
| | 2.66 mg/L | February/March 2006 |
| | 1.62 mg/L | February/March 2006 |
| | 1.82 mg/L | February/March 2006 |
| | 3.57 mg/l | August 2005 |
| Uranium<br>MCL = 0.30 mg/L | 22.1 pCi/L | August 2005 |
| Chromium<br>MCL = 0.1 mg/l | 0.219/0.232 mg/L+ | April 2006 |
| | 0.208/0.197 mg/L+ (dup) | April 2006 |
| | 0.133/0.169 mg/L+ | April 2006 |
| Trichloroethene (TCE)<br>MCL = 5 µg/L | 15.3 µg/L | November/December 2005 |
| | 15.8 µg/L | January/February/March 2006 |
| | 14.9 µg/L | May 2006 |
| | 12.9 µg/L | August/ September 2006 |
| | 5.37 µg/L | May 2006 |
| | 5.81 µg/L (dup) | November/December 2005 |
| | 6.34 µg/L | August/September 2006 |
| | 5.07 µg/L | October/ November 2005 |
| | 7.61 µg/L | October/ November 2005 |
| | 7.85 µg/L | January/ February 2006 |
| | 6.73 µg/L | April/ May 2006 |
| | 7.87 µg/L | July/August 2006 |
| Nitrate (as Nitrogen)<br>MCL = 10 mg/L | 10.6 mg/L | November/ December 2005 |
| | 13.3 mg/L | January/February/ March 2006 |
| | 13.0 mg/L | August/ September 2006 |
| | 12.0 mg/L | May 2006 |
| | 25.2 mg/L | October/ November 2005 |
| | 25.2 mg/L | January/ February 2006 |
| | 25.5 mg/L | April/ May 2006 |
| | 24.9 mg/L (dup) | April/ May 2006 |
| | 28.8 mg/L | July/ August 2006 |
| | 10.2 mg/L | January/ February 2006 |
| | 10.2 mg/ L (dup) | January/ February 2006 |
| | 10.1 mg/L | January February 2006 |
| | 25.4 mg/L | October/ November 2005 |
| | 26.1 mg/L | January/ February 2006 |
| | 25.2 mg/L | April/ May 2006 |
| | 17.4 mg/L | July/August 2006 |
| | 28.0 mg/L | October/ November 2005 |
| | 29.0 mg/L | January/ February 2006 |
| | 28.9 mg/L | April/ May 2006 |
| | 27.5 mg/L | July/ August 2006 |

**Table E.4-1—ER Project Groundwater Monitoring Results from Calendar Year 2006 (continued)**

| Sample | Concentration | Period |
|---|---|---|
| Nitrate (as Nitrogen)<br>MCL = 10 mg/L | 20.6 mg/L (dup) | July/August 2006 |
| | 23.9 mg/L | March 2006 |
| | 24.1 mg/L (dup) | March 2006 |
| | 32.6 mg/L | June 2006 |
| | 29.5 mg/L (dup) | June 2006 |
| | 30.4 mg/L | September 2006 |
| Gross Alpha<br>Corrected [a]<br>MCL = 15 pCi/L | 21.6 pCi/L | February/ March 2006 |
| Gross Alpha<br>Uncorrected<br>MCL = 15 pCi/L | 15.7 $\pm$ 1.92 pCi/L | August 2006 |
| | 37.8 $\pm$ 11.1 pCi/L | June 2006 |
| | 34.0 $\pm$ 10.6 pCi/L | June 2006 |

Source: SNL/NM 2007.
[a]Corrected gross alpha accounts for natural uranium levels in the surrounding environment.
dup = duplicate sample
MAC = maximum allowable concentration
MCL = maximum contaminant level
mg/L = milligrams per liter
pCi/L = picocuries per liter
µg/L = micrograms per liter

Studies by the New Mexico Bureau of Mines and Mineral Resources and the USGS have concluded that the volume of water-producing zone within the Albuquerque Aquifer is much less than earlier studies had estimated (NMMMR 1992; USGS 1993, 1995). USGS estimated the aquifer is being depleted at a rate that is twice that of the recharge to the aquifer from the Rio Grande and other sources (USGS 1995). As a result, the reliance on the regional Albuquerque Aquifer as the sole drinking water source for the City, including SNL and KAFB facilities, is unsustainable.

## E.5 COMMUNITIES ALONG THE RIO GRANDE

Most communities use groundwater for drinking water sources. Predominant communities along the upper and middle Rio Grande basins are the Town of Taos, Cities of Española, Los Alamos, Santa Fe and Albuquerque, Pueblo of Taos, Ohkay Owingeh Pueblo (formerly San Juan Pueblo), Pojoaque Pueblo, Tesuque Pueblo, San Ildefonso Pueblo, Picuris Pueblo, Cochiti Pueblo, Santa Ana Pueblo, and Sandia Pueblo. Surface water contamination issues are of particular importance to area Pueblos, as many use local surface water sources for sacred and traditional ceremonies, including immersion in and ingestion of untreated surface waters.

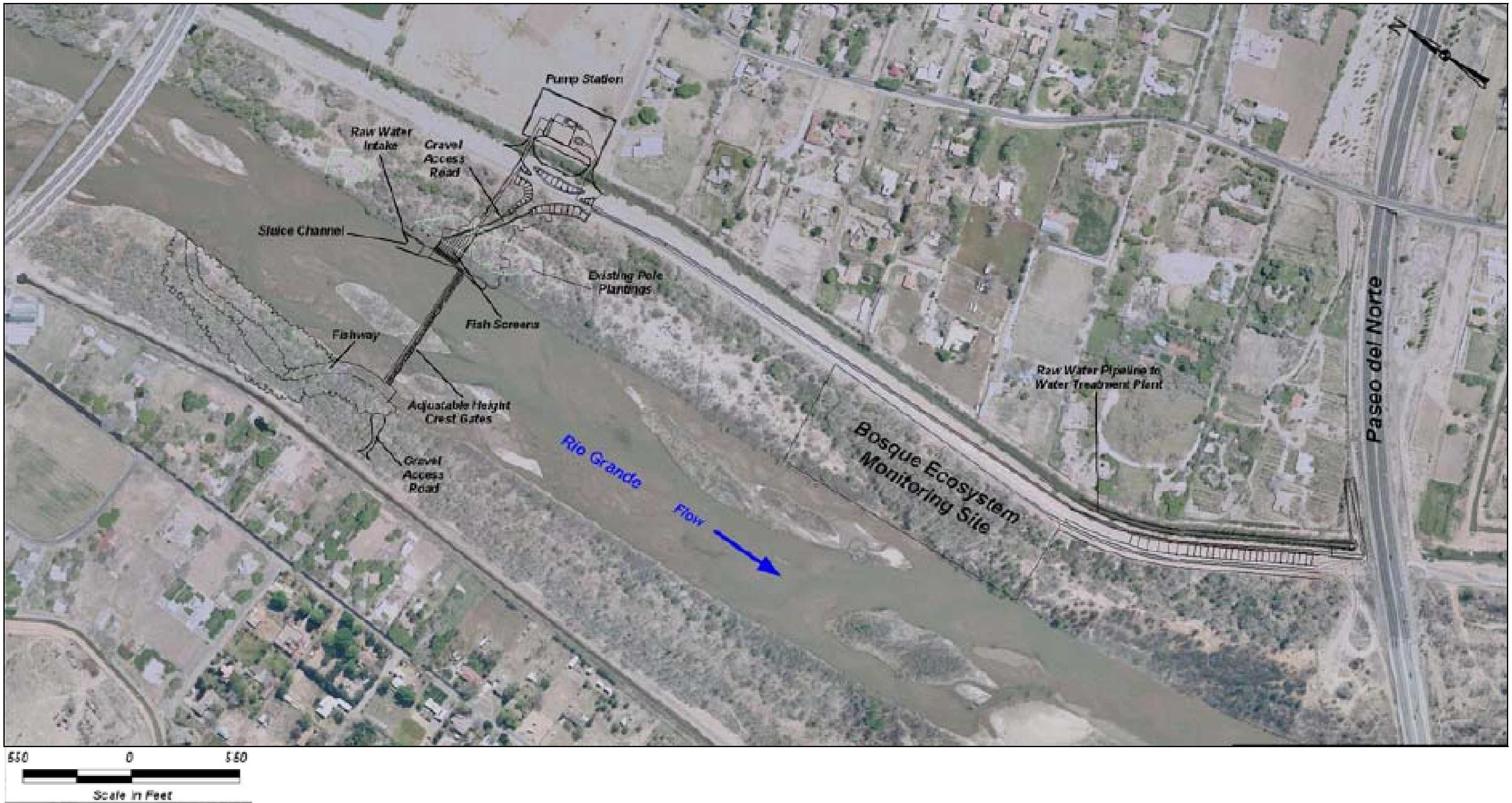
Recent challenges to drinking water resources, such as drought conditions, ground subsidence, and contamination issues, are forcing communities to seek alternative sources to replace or augment their present drinking water sources. In 2006, the BOR converted the original water service contracts for the San Juan-Chama Project, enabling individual communities to access directly their allotments of San Juan-Chama water (OSE 2006). Seven communities in the upper and middle Rio Grande basins have expressed an interest in direct access to San Juan-Chama water delivered by the Rio Grande: the City of Santa Fe, City of Española, Town of Taos, Santa Fe County, Los Alamos County, Village of Los Lunas, and the Village of Taos Ski Valley. At this time, none of the Pueblos have expressed an interest in pursuing similar projects. The City of Albuquerque and the USFS, on behalf of the City of Santa Fe, Santa Fe County, and Las Campanas Limited Liability Corporation (Las Campanas), are pursuing diversions on the Rio Grande to access San Juan-Chama surface water for community drinking water. Each project is described below.

### E.5.1 City of Albuquerque Drinking Water Supply Project (CABQ and USBR 2004)

With the implementation of the San Juan-Chama Drinking Water Project, the City of Albuquerque projects the need for pumping groundwater would be substantially reduced to approximately 730,000 acre-feet per year by 2060 (CABQ and USBR 2004). For the 2006-2040 period, the USGS projects the overall annual aquifer recovery to range between 187,000 acre-feet per year to 242,000 acre-feet per year with the implementation of water conservation programs and the San Juan-Chama Drinking Water Project (USGS 2004). The San Juan-Chama, Drinking Water Project is projected to supply approximately 70-percent of the City of Albuquerque's future water use (CABQ 2008).

Several projects are necessary to complete the infrastructure requirement for the Drinking Water Supply Project. These projects, collectively referred to as the San Juan-Chama Drinking Water Project, are proposed to reduce the dependency on groundwater resources (CABQ 2005). The San Juan-Chama Drinking Water Project consists of four elements: diverting surface water from the Rio Grande; transporting the raw water to a new water treatment plant; treating the raw water to drinking water standards; and distributing the treated, potable water to the community. The construction of a diversion to utilize about 97,000 acre-feet per year of San Juan-Chama and Rio Grande surface water is in progress- scheduled for completion in 2007. Figure E.5-1 shows the diversion structure. The North I-25 Industrial Recycling and Northside Non-Potable Surface Water Reclamation Projects have been completed. The Southside Water Reclamation Plant is designed to provide safe use of surface water directly for municipal water supply and is scheduled to be completed in 2008.

With the implementation of the San Juan-Chama Drinking Water Project, the City of Albuquerque projects the need for pumping groundwater would be substantially reduced to approximately 730,000 acre-feet per year by 2060 (CABQ and USBR 2004), which would reduce aquifer drawdown from 3-5 feet per yr to 1-3 feet per year (Stomp 2006). For the period 1994 to 2020, the USGS projects the overall annual aquifer withdrawal for the City to range between 98,700 acre-feet per year to 177,000 acre-feet per year (32,178.37 – 57,705.89 million gallons per year) (USGS 1995). Implementation of the San Juan-Chama Drinking Water Project is projected to supply approximately 70-percent of the City of Albuquerque's future water use (CABQ 1997).




Source: CABQ and USBR 2004.

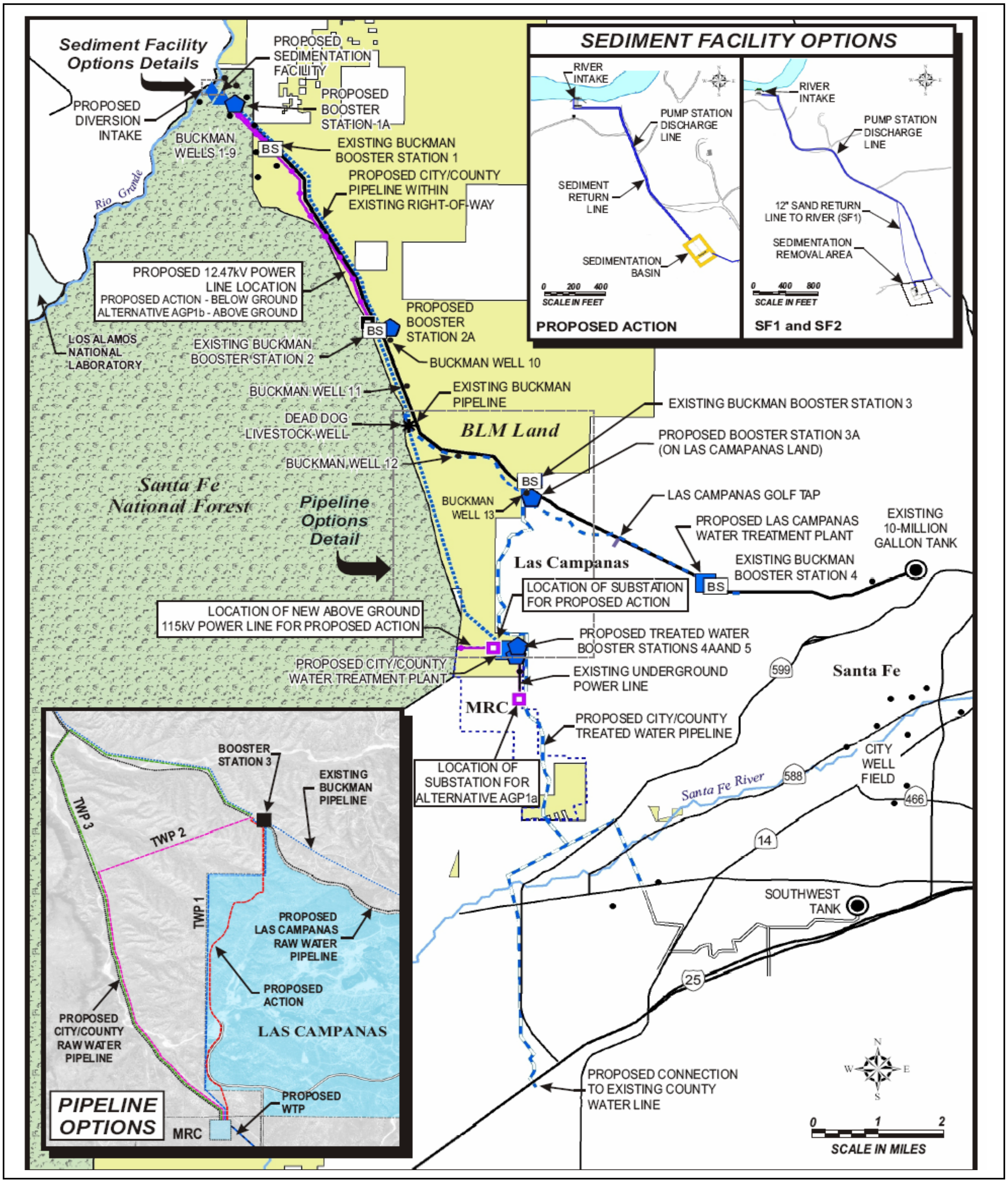
**Figure E.5-1—Map of Paseo del Norte Diversion Structure for the CABQ Drinking Water Supply Project**

### E.5.2 U.S. Forest Service Buckman Water Diversion Project (USFS 2004)

As demonstrated by drought conditions in 1996, 2000, and 2002, continuing water shortages in the City of Santa Fe and Santa Fe County resulted in a critical and immediate need for water. Presently, the City and County utilize groundwater resources from the Buckman Well Field for community drinking water sources. However, the well field cannot provide a reliable and sustainable source of water. Well yields have been reduced; hydraulic heads in the confined ground water aquifer near the well field have undergone substantial declines; and depletions of nearby streams could cause limitations to pumping. At current well production levels, undesirable consequences to ground water levels and continued depletion of nearby streams are expected to occur unless an alternate reliable water supply is found. In addition to ground water concerns, storage levels in the City's two surface water reservoirs located on the Santa Fe River, a tributary of the Rio Grande, fluctuate widely depending on seasonal and annual runoff conditions and potable water demand. These reservoirs receive surface water runoff from the Santa Fe Canyon watershed above the City. Overall Santa Fe River reservoir capacities cannot provide the necessary dependability to provide the water quantities needed to sustain the Santa Fe region during drought conditions.

The proposed Buckman Water Diversion Project (Buckman Project) is designed to address the immediate need for a sustainable means of accessing water supplies for the applicants, the City of Santa Fe, New Mexico (City), Santa Fe County (County), and Las Campanas Limited Partnership (Las Campanas). Most of the water to be diverted would be derived from the San Juan-Chama Project, which is a U.S. Bureau of Reclamation (Reclamation) inter-basin water transfer project that supplies water from the greater Colorado River basin to the Rio Grande basin through a tunnel system. The remainder would be native water rights owned by the parties and diverted from the Rio Grande. The proposed point of diversion is located on the east bank of the Rio Grande in northern New Mexico, about 15 miles northwest of the City of Santa Fe. It is located about 3 miles downstream from where Route 4 crosses the Rio Grande at the Otowi Bridge, which is where streamflow data have been recorded by the U.S. Geological Survey (USGS) for more than a century. In addition to the diversion, the project would involve treatment and conveyance of water through pipelines that would generally follow roads and existing utility corridors.

The facilities necessary to implement the Buckman Project include a diversion structure on the eastern bank of the Rio Grande, sediment separation facilities, booster stations, storage and treatment facilities, water conveyance pipelines, Buckman Road improvements, and power upgrades. The locations of facilities associated with the Proposed Action and other alternatives are illustrated on Figure 7. Two new water treatment plants would be required, where the raw water would be processed to safe drinking water standards. The Las Campanas treatment plant would be located on Las Campanas land and operated by Las Campanas. The City and County treatment plant would be located on U.S. Bureau of Land Management land leased to the City, just west of Caja del Rio Road. New treated water pipelines would be installed from the treatment plants to convey water into the existing Las Campanas and City and County water distribution systems.




Source: USFS 2004.

**Figure E.5-2—Map of Proposed Buckman Water Diversion Project**

Estimated water diversion quantities are based on annual demand projections that extend to the year 2010 for the City and County, while the demand for Las Campanas is projected through community build out (1,717 homes). These projections translate to approximately 8,730 acre-feet per year, currently estimated to be 5,230 acre-feet per year for the City; 1,700 acre-feet per year for the County; and 1,800 ac-ft per yr for Las Campanas. The proposed diversion facility is sized for a combined net peak diversion of approximately 28.2 cubic feet per second, which meets the combined peak needs of the City, County, and Las Campanas.

The USFS is coordinating with Federal and state agencies to address environmental concerns. The final environmental impact statement will be released in 2007. Upon release, the public will be given an opportunity to provide comments on the document.

### E.5.3 City of Española Drinking Water Project (BOR and CE 2002)

The City of Española is facing tremendous challenges in its ability to provide potable water with good groundwater resources in sufficient quantities to meet even basic demand requirements of the local communities. Since 1986, the City has been forced to abandon seven of the thirteen groundwater production wells, due to either contamination or well failure. The contaminants include solvents, fluoride, and nitrates wither naturally occurring or from on-site wastewater disposal systems (e.g., septic systems) located throughout the Española Valley. The City of Española is exploring alternative water resources, including surface water diversion of San Juan-Chama water from the Rio Grande. The City of Española is working with the BOR to develop a project description. Engineering planning documents are being developed to facilitate the discussion of a diversion as a viable solution to the drinking water source challenges facing the City of Española.

## E.6 CONCLUSION

Contaminant pathways into the Rio Grande and onto public lands are still being studied and are poorly understood due to the complex geohydrology of northern New Mexico. Area studies and LANL have confirmed that radioactive and toxic wastes of LANL origin have reached the Rio Grande. While contamination from DOE activities has occurred, it has not caused exceedances of regulatory standards off-site. Both LANL and SNL have contamination from legacy wastes created during the Cold War era, prior to modern environmental laws and regulations. Contamination of surface water and groundwater has been documented at LANL and SNL. The results from ongoing environmental monitoring programs at LANL and SNL were consistent with historical measurements and did not exceed Federal or state standards.

Communities and Pueblos in the upper and middle Rio Grande basins traditionally use groundwater sources for community drinking water. Many Pueblos use surface waters for traditional and ceremonial uses. The three largest communities in the upper and middle Rio Grande basins are seeking alternative drinking water supply resources. Presently, they all utilize groundwater aquifers and the primary drinking water source. Challenges from drought conditions, contaminants (naturally occurring and human-caused), and land subsidence, has heightened the need for communities to provide a sustainable water supply. The City of Albuquerque has initiated construction on diversion structure and the necessary infrastructure to facilitate the use of surface water from the Rio Grande. The City of Albuquerque will use 48,200 acre-feet per year of San Juan-Chama water and approximately 47,000 acre-feet per year of native Rio Grande surface water. After the San Juan-Cham water is fully consumed, the native Rio Grande water, approximately 47,000 acre-feet per year, would be returned to the Rio Grande. The USFS is completing the environmental impact statement for the proposed Buckman Project, which would supply 3,500 acre-feet per year of surface water from the Rio Grande to the City of Santa Fe, Santa Fe County and Las Campanas subdivision in Santa Fe County. The USFS is expected to issue the final environmental impact statement in 2007. The City of Española has expressed an interest in developing a surface water diversion on the Rio Grande and is presently developing preliminary planning documents to further explore this option.

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